ANNUAL REPORT 1965

FORT WILLIAM

water pollution control plant

DIVISION OF PLANT OPERATIONS
Ontario Water Resources Commission

ONTARIO WATER RESOURCES COMMISSION

OFFICE OF THE GENERAL MANAGER

Members of the Fort William Local Advisory Committee,
City of Fort William.

Gentlemen:

I am pleased to provide you with the 1965 Annual Report for the Fort William Water Pollution Control Plant, OWRC Project Nos. 60-S-50 and 61-S-91.

We appreciate the co-operation you have extended to our Operations staff throughout the year, and trust that continuation of this close association will ensure even greater progress in the sphere of water pollution control.

Yours very truly,

D. S. Caverly,
General Manager.

ONTARIO WATER RESOURCES COMMISSION

801 BAY STREET

TORONTO 5

J. A. VANCE, LL.D.
CHAIRMAN

J. H. H. ROOT, M.P.P.
VICE-CHAIRMAN

D. S. CAVERLY
GENERAL MANAGER

W. S. MacDONNELL
COMMISSION SECRETARY

General Manager,
Ontario Water Resources Commission.

Dear Sir:

I am pleased to provide you with the 1965 Annual Report on the operation of the Fort William Water Pollution Control Plant, OWRC Project Nos. 60-S-50 and 61-S-91.

The report presents design data, outlines operating problems encountered during the year and summarizes in graphs, charts and tables all significant flow and cost data.

Yours very truly,

B. C. Palmer, P. Eng.,
Director,
Division of Plant Operations.

FOREWORD

This report provides useful information on the operating efficiency of this project during 1965. It is intended to act as a guide in gauging plant performance. To implement that aim, it includes detailed statistical and cost data, a description of the project and a summary of its operation during the year.

Of particular interest will be the cost data, which show the total cost to the municipality and the areas of major expenditure.

The Regional Operations Engineer is primarily responsible for the preparation of the report, and has compiled and arranged the material. He will be pleased to answer any questions regarding it. Other groups, however, were involved in the production, and these include the statistics section, the Drafting Section of the Division of Sanitary Engineering and the Division of Finance.

B. C. Palmer, P. Eng.,
Director,
Division of Plant Operations.

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FORT WILLIAM

water pollution control plant

operated for

THE CITY OF FORT WILLIAM

by the

ONTARIO WATER RESOURCES COMMISSION

CHAIRMAN: Dr. James A. Vance

VICE-CHAIRMAN: J. H. H. Root, M.P.P.

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D. A. Moodie
H. E. Brown
L. E. Venchiarutti

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F. A. Voege
K. H. Sharpe
A. K. Watt

COMMISSION SECRETARY

W. S. MacDonnell

DIVISION OF PLANT OPERATIONS

DIRECTOR: B. C. Palmer

Assistant Director: C. W. Perry
Regional Supervisor: A. C. Beattie
Operations Engineer: A. Clark

801 Bay Street Toronto 5

'65 REVIEW

This was the first full year of operation for the Fort William Water Pollution Control Plant.

During 1965, 676.38 million gallons of raw sewage were treated. The cost of this treatment was $53,523.57 or $79.13 per million gallons, while 81.2 tons of 5 day BOD and 196.2 tons of SS were removed. The percent removal was normal for a primary treatment plant.

The unit cost of treatment is high due to the low flows being received. As the flow increases to the plant capacity, overall costs will increase but unit costs will decrease.

Plant flow during winter months was extremely low.

Due to the few sewers connected to the WPCP, the dry weather flow was extremely low, being less than 1 mgd. This occurred in mid-winter (when the ground was frozen) and late summer (when the ground was dry).

In the spring, thawing conditions raised the flow to 4.00 mgd and in fall, rain caused flow in excess of 2.5 mgd.

It is anticipated that the completion of a trunk sewer in 1966 will increase the flow substantially.

Late in 1965 the plant staff assumed operation of the newly renovated Brunswick Avenue Sewage Pumping Station. The cost of this operation will be included with the plant operating costs.

GLOSSARY

BOD	biochemical oxygen demand (a measure of organic content)
cfm	cubic feet per minute
comminution	shredding of solids into small fragments
DWF	dry weather flow
effluent	outflow
flocculation	bringing very small particles together to form a larger mass (the floc) before settling
fps	feet per second
gpcd	gallons per capita per day
gpm	gallons per minute
grit	sand, dust, stones, cinders and other heavy inorganic material
influent	inflow
lin. ft.	lineal feet
mgd	million gallons per day
mlss	mixed liquor suspended solids
ppm	parts per million
ss	suspended solids
TDH	total dynamic head (usually refers to pressure on a pump when it is in operation)

HISTORY
1956 - 1965

INCEPTION

In September, 1956, the City of Fort William requested the Ontario Water Resources Commission to finance, construct and operate water pollution control facilities in the municipality. The firm of W. L. Wardrop and Associates Limited was engaged to prepare plans and specifications for the project.

APPROVAL

Ontario Municipal Board approval for the project was granted in November, 1959. An agreement with the Ontario Water Resources Commission to finance, construct and operate the works was subsequently executed.

CONSTRUCTION

McNamara Construction Company of Ontario Limited, Leaside, Ontario, completed construction of the interceptor sewers in October, 1962. Hacquoil Construction Limited completed the construction of the influent and outfall sewers in August, 1963. Schwenger Construction Limited, Burlington, Ontario, completed construction of the plant in March, 1964.

TOTAL COST

The total cost was $3,926,193.66

A. T. ROBSON
CHIEF OPERATOR

Mechanic - E. E. Blanshard

Operators

W. K. Corbett R. R. Phillips
L. A. McNaughton

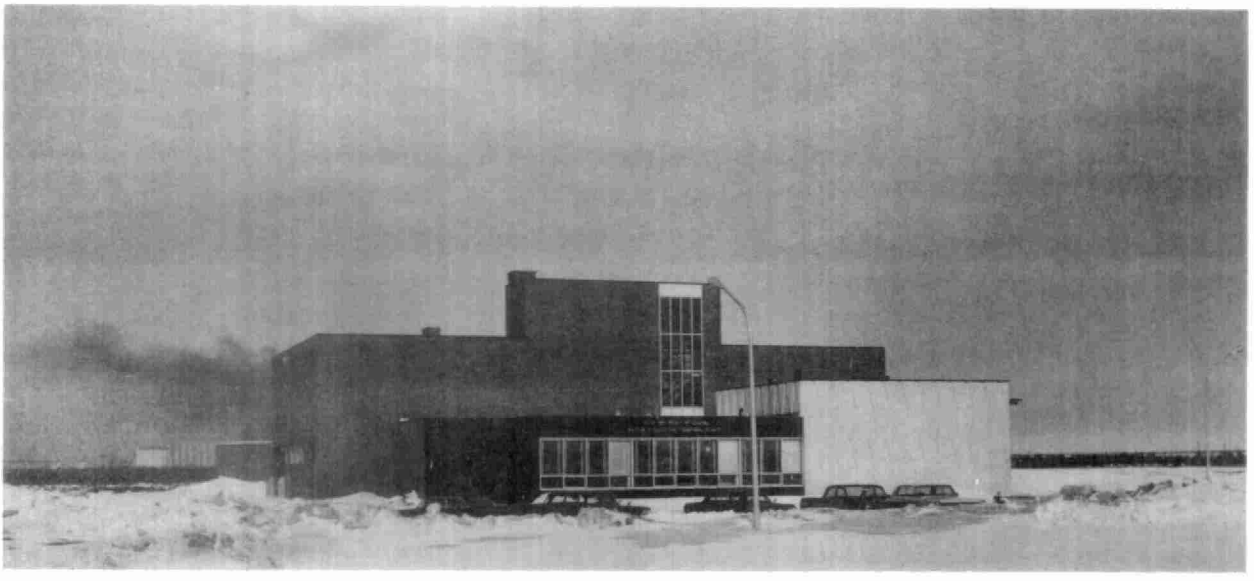
Project Staff

COMMENTS

Mr. Robson has been the Chief Operator since the beginning of operation in 1964. He has successfully completed the Basic Sewage Works Operators Course. It is anticipated that he will complete the Intermediate and Senior courses by the end of 1966.

During 1965, Mr. L. G. Martin resigned from the plant staff. Mr. Phillips the Groundsman was promoted to status of Operator and a casual labourer was hired for groundsman's duties.

After the summer months it was decided to change from 16 to 8 hour operation and to eliminate the position of Groundsman. To the end of 1965 this experiment has proved successful but some re-scheduling will be required during spring runoff and high flow periods.



Description of Project

PRE-SEDIMENTATION

The city sewer system delivers waste water to the plant where it enters through the screen room. In this room, self-cleaning screens remove any large objects which may infiltrate the sewer system.

The waste water flows from the screen room into a wet well, which is primarily a pump suction chamber, from where main pumps raise the waste water and discharge it into a channel leading to the grit tank. From this channel the flow throughout the remainder of the plant is by gravity.

SEDIMENTATION OF INORGANICS

In the grit tank the velocity of flow is reduced sufficiently to allow the heavier particles of grit and sand to settle out. Air is blown into the tank to keep the organic solids in suspension. A clam-shell bucket hoist is used to periodically remove the accumulated sand and grit which is trucked away to a disposal area. Following this initial settling, the flow then passes through another channel into the settling tanks. This channel contains a flume which measures the flow passing through the plant.

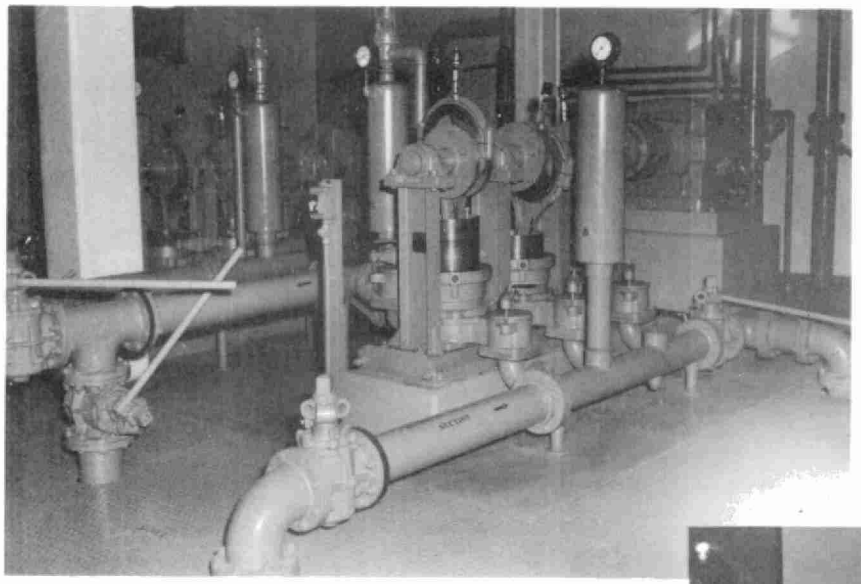
SEDIMENTATION OF ORGANICS

The waste water enters one of the two settling tanks and undergoes a detention period of approximately two hours to allow the heavier solids (sludge) to settle to the bottom of the tanks for removal.

The tanks are equipped with submerged sludge removal and floating scum removal mechanisms. The sludge is periodically drawn off from the bottom of the tanks and, with surface scum material, is pumped to the digesters for treatment. The treated waste water (effluent) flows over the effluent weirs of the tanks into another channel which discharges it to an outfall chamber.

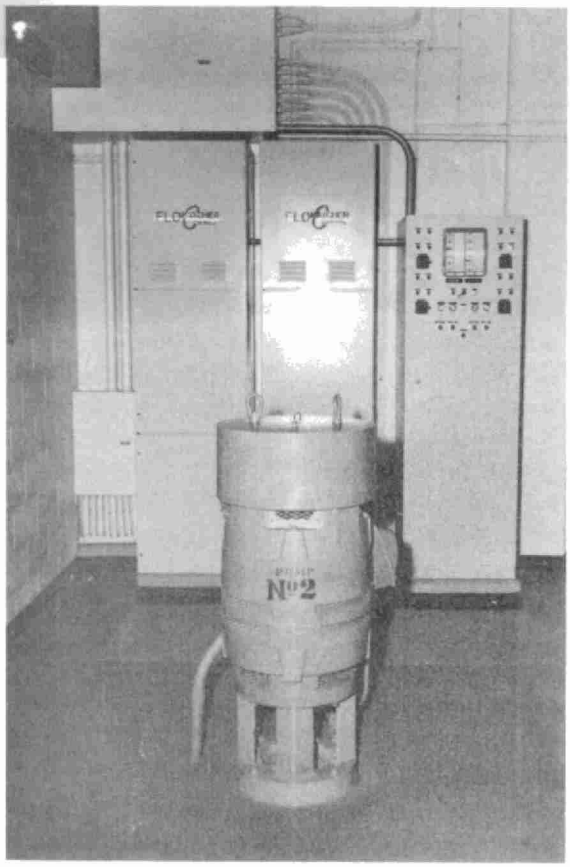
CHLORINATION

Chlorine is added through the influent



AT LEFT:
DIGESTER SLUDGE PUMP

BELOW:
MAIN PUMP AND FLOMATCHER



wet well for odour control, and to the effluent discharge for bacterial reduction. The outfall chamber and sewer double as a chlorine contact chamber to effect chlorination of the effluent.

The outfall sewer discharges into the Kam River.

SLUDGE TREATMENT

The sludge removed from the settling tanks is treated in two stages called primary and secondary digestion.

The sludge from the settling tanks is pumped to the primary digester. In the absence of air, and at a regulated temperature of 90° F., the decomposing or digestion process takes place. The sludge is broken down by anaerobic bacterial action and, when thoroughly digested, it is a thick, black, odourless liquid. Constant agitation within this tank ensures overall treatment.

The secondary digester receives the digested material from the primary stage and completes the process. The secondary digester is not agitated but is allowed to be quiescent. The supernatant is decanted and returned to the flow. Sludge gas (principally methane) which is formed during the process is used as a fuel for the heat exchangers and boilers supplying heat to the digesters and buildings. The standby fuel is natural gas.

SLUDGE REMOVAL

The digested sludge is removed by tank truck for final disposal.

PROJECT COSTS

NET CAPITAL:		
60-S-50 (Final)	$1,336,345.25	
61-S-91 (Estimated)	2,589,848.41	$3,926,193.66
DEDUCT- Portion financed by CMHC		
60-S-50 (Final)	855,626.69	
61-S-91 (Estimated)	1,722,029.58	2,577,656.27
Long Term Debt to OWRC		
60-S-50	480,718.56	
61-S-91	867,818.83	
		$1,348,537.39

Debt Retirement Balance at Credit (Sinking Fund) December 31, 1965		
60-S-50	$ 30,345.37	
61-S-91	17,895.97	$ 48,241.34

BILLINGS

	60-S-50	61-S-91	Total
Net Operating	$ 123.71	$ 53,523.57	$ 53,647.28
Debt Retirement	9,701.00	17,532.00	27,233.00
Reserve	9,258.74	16,072.79	25,331.53
Interest Charged	26,971.69	49,765.89	76,737.58
Total	$46,055.14	$136,894.25	$182,949.39

RESERVE ACCOUNT

	60-S-50	61-S-91	Total
Balance at Jan. 1, 1965	$ 21,050.58	$ -	$ 21,050.58
Deposited by Municipality	9,258.74	16,072.79	25,331.53
Interest Earned	1,363.77	338.08	1,701.85
	$ 31,673.09	$ 16,410.87	$ 48,083.96
Less Expenditures	-	-	-
Balance at Dec. 31, 1965	$ 31,673.09	$ 16,410.87	$ 48,083.96

MONTHLY OPERATING COSTS

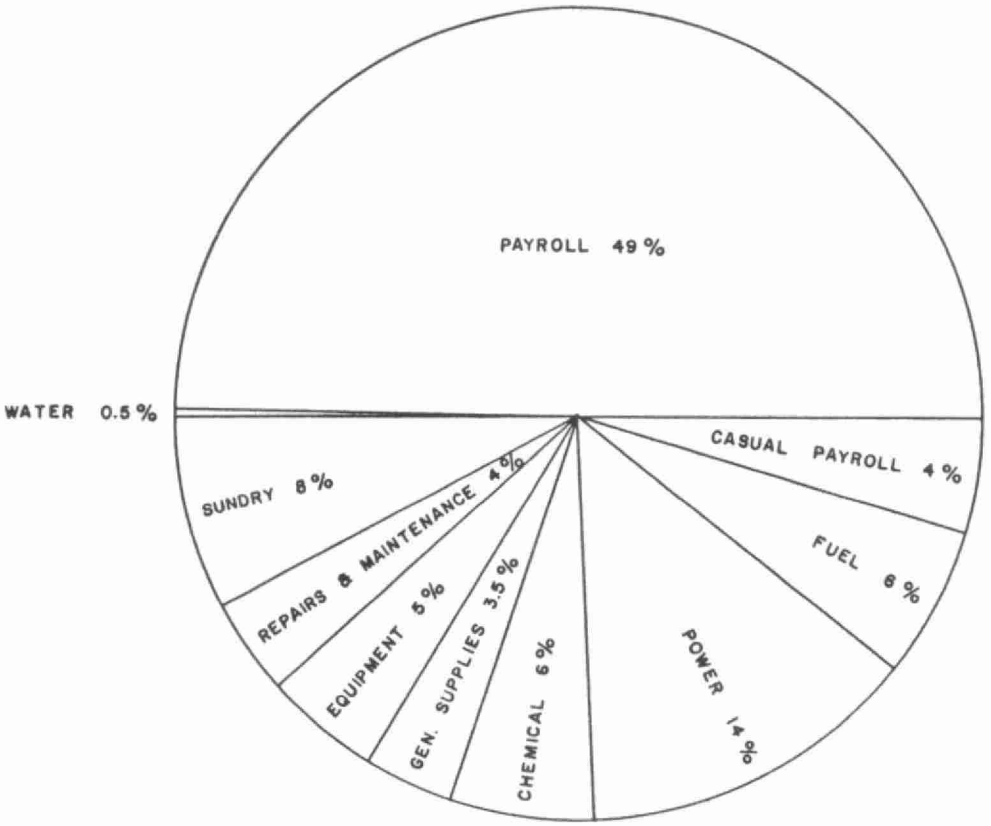
MONTH	TOTAL EXPENDITURE	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIPMENT	REPAIRS & MAINTENANCE	SUNDRY	WATER
JAN	2507.94	1818.86		398.04			84.68	99.13		62.23	45.00
FEB	3603.85	1805.56	209.44	428.10	604.38		171.33	165.75	180.97	38.32	
MARCH	3588.73	2105.56		452.40	556.79		174.71	114.73	153.27	31.27	
APRIL	4617.62	2345.17		371.31	691.33		92.02	79.23	859.22	126.24	53.10
MAY	5472.15	3158.34		338.77	723.10	1009.40	74.99		114.17	48.38	
JUNE	3824.83	2181.95	118.80	287.96	674.95		157.49	13.21	233.87	156.60	
JULY	4662.92	2162.20	244.20	212.54	704.19	1009.40	152.79	18.44	37.96	72.60	48.60
AUG	3831.31	1895.12	627.82	103.87	560.00		178.87	190.29	93.50	181.84	
SEPT	3445.85	2192.71	263.93	123.30	633.57		97.70		73.80	60.84	
OCT	6274.28	2862.04	396.00	170.04	678.71	1077.71	86.54	843.86	65.55	40.23	48.60
NOV	3573.56	2042.28	198.00	217.31	567.90		246.35	21.58	126.96	153.18	
DEC	8120.53	2022.57	316.80	106.84	904.09		472.71	921.58	144.03	3183.31	48.60
TOTAL	53523.57	26592.36	2374.99	3210.48	7304.01	3096.51	1990.18	2472.80	2083.30	4155.04	243.90

YEARLY OPERATING COSTS

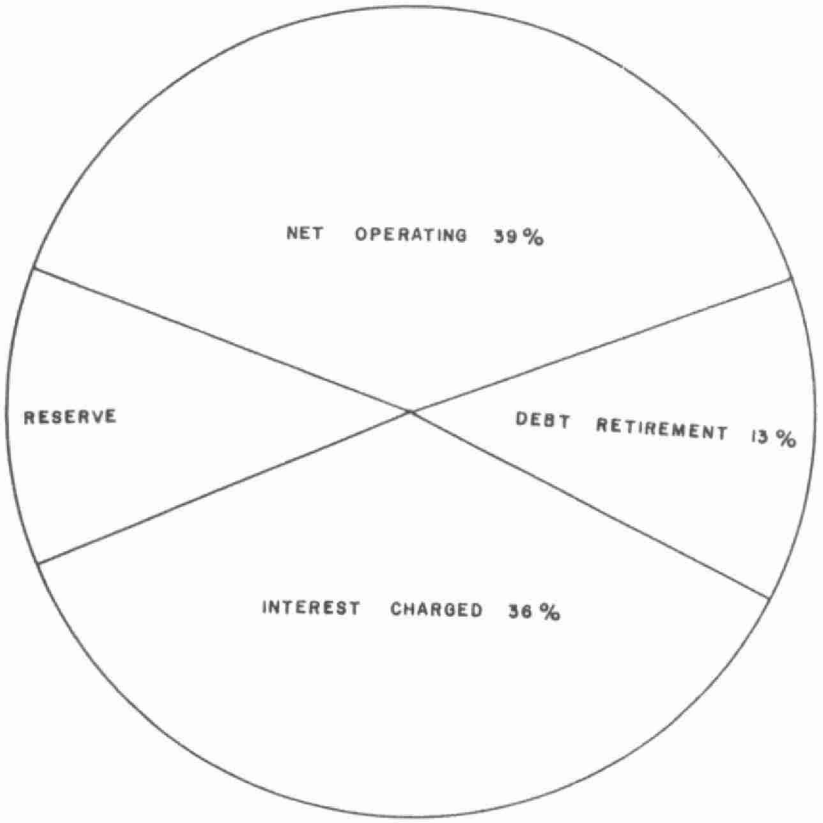
YEAR	M.G. TREATED	TOTAL COST	COST PER FAMILY PER YEAR	COST PER MILLION GALLONS	COST PER L.B. OF BOD REMOVED
1965	676.38	53523.57	* 4.48	79.13	23 CENTS

* BASED ON ANNUAL POPULATION ESTIMATE AND 3.9 PERSONS PER FAMILY

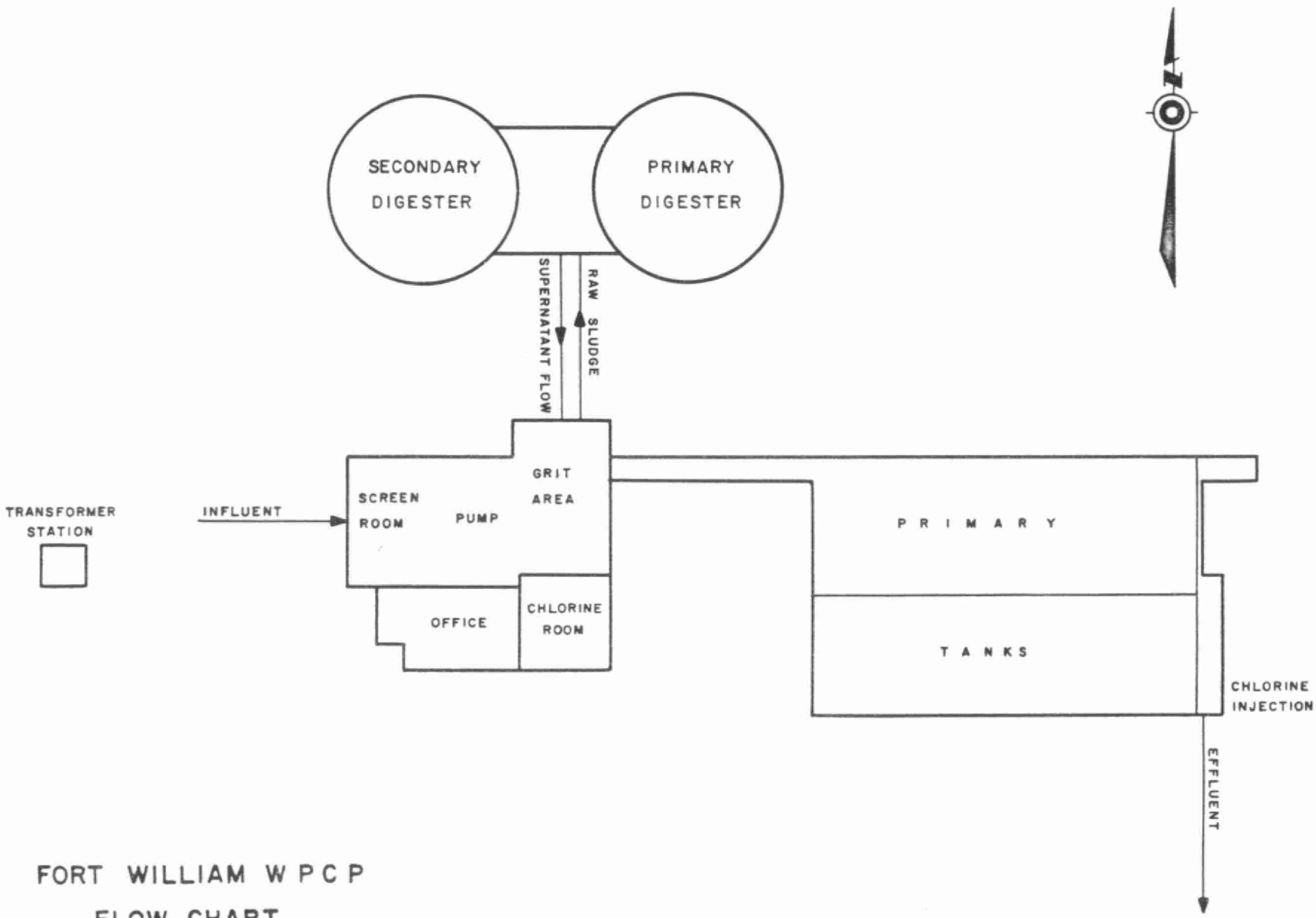
1965 OPERATING COSTS



TOTAL ANNUAL COST
(61 - S - 91 ONLY)



Technical Section



FORT WILLIAM W P C P

FLOW CHART

Design-Data

GENERAL

Type of Plant - Primary treatment with two stage digestion.

Design Population - 48,000

Design Plant Flow - 6 mgd

Per Capita Flow - 125 gpd

PRIMARY TREATMENT

Grit Removal

Aerated grit chamber

Size 29' x 25' x 15' deep

Detention Time - 1.5 minutes at 6.0 mgd

Sewage Lift Pumps

Sizes - two 7.4 mgd infinitely variable from 3.0 - 7.4 mgd.

- two 4.3 mgd infinitely variable from 1.2 - 4.3 mgd.

Flow matcher, liquid rheostat with wound rotor motors.

Primary Sedimentation Tanks

Type - 2 rectangular parallel units

Size - 132' x 37' x 8' deep

Retention - 2.5 hours

Surface Settling Rate - 600 gallons per sq, ft. per day.

Overflow Rate - 10,000 gallons per ft. of weir per day.

Digesters

Size - 2 digesters 60 ft. in diameter

Capacity - 71,000 cu. ft. each

Loading - 1.5 lbs. of solids per cubic ft. per month

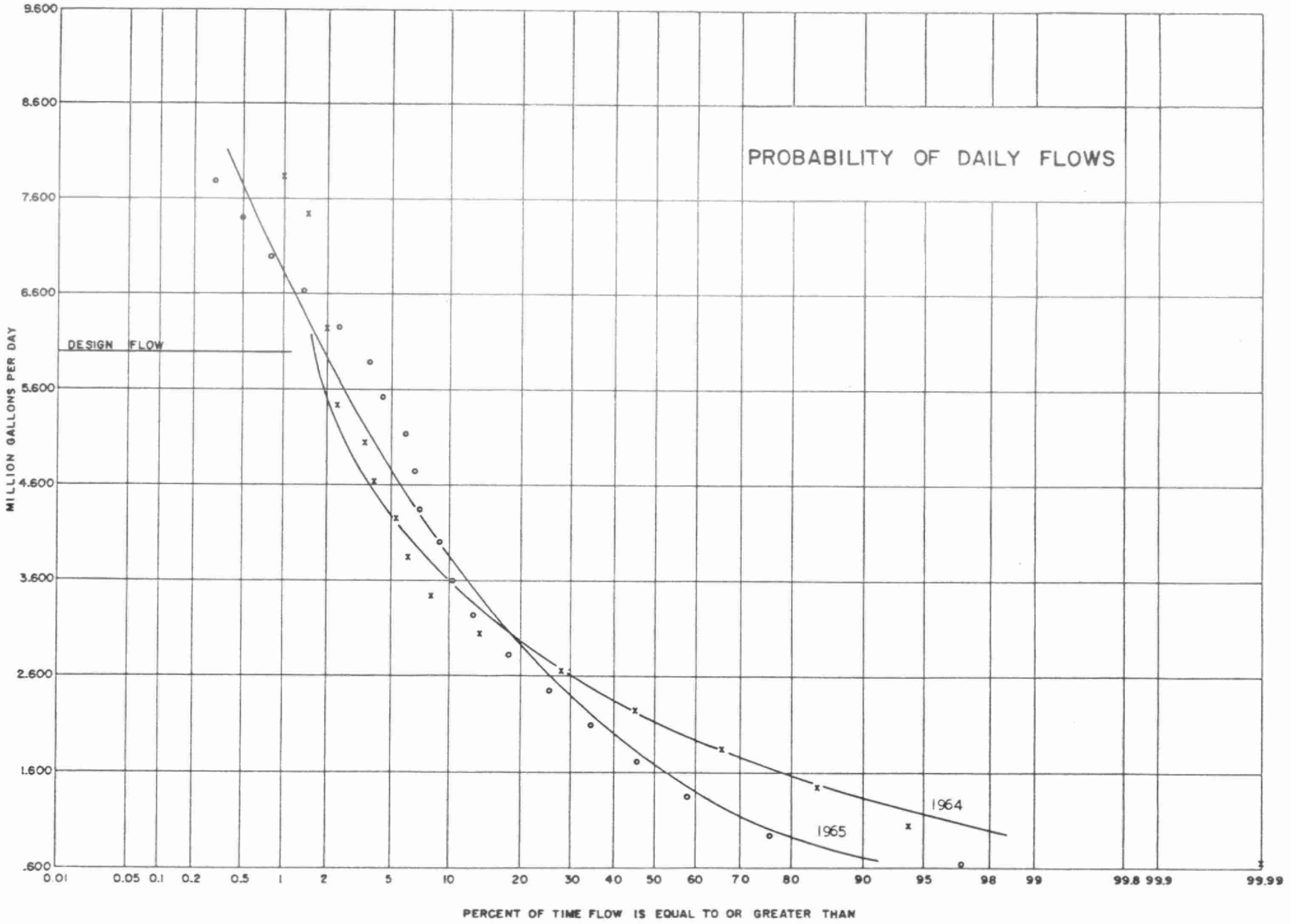
Outfall

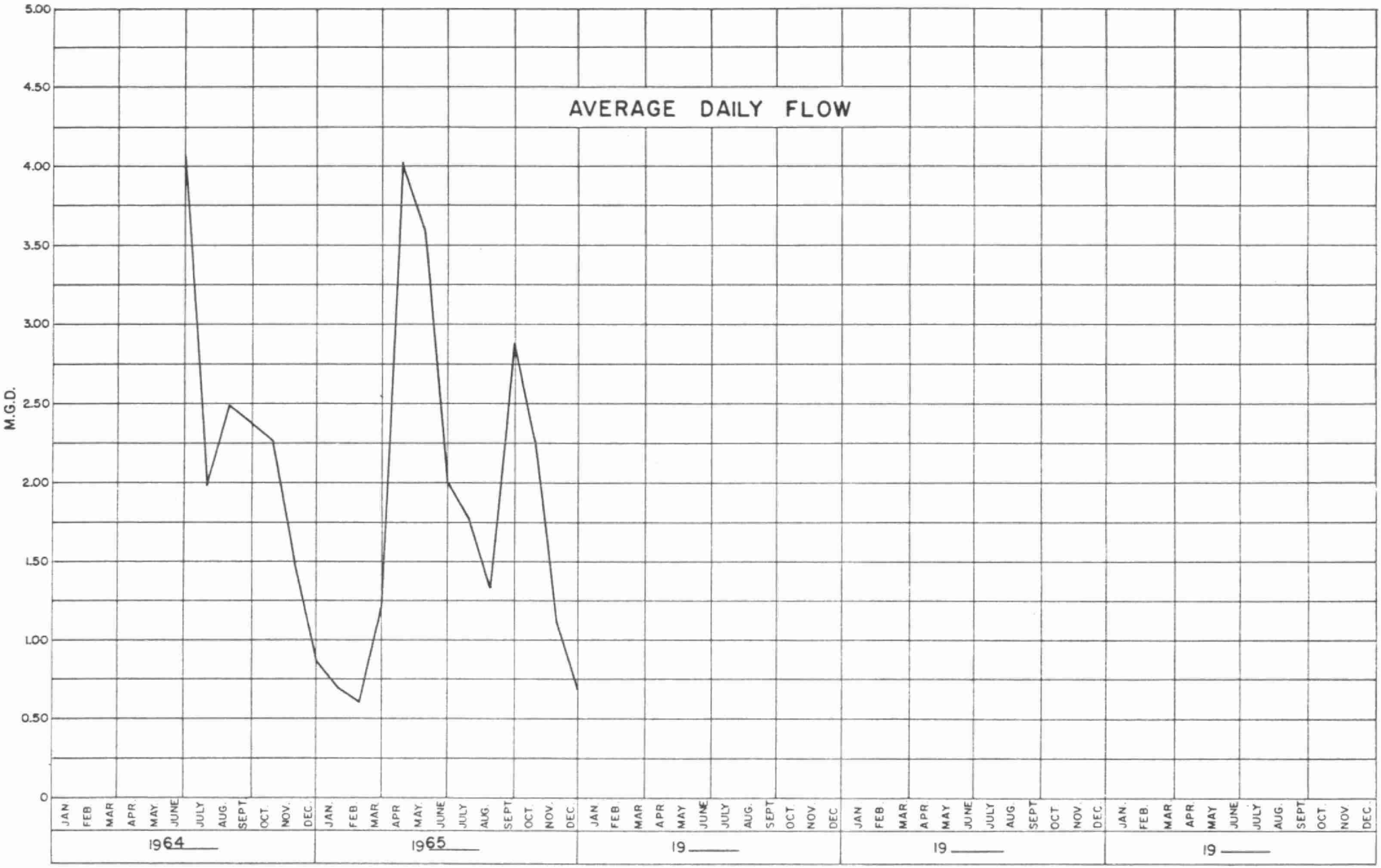
Size - 42 inch diameter reinforced concrete pipe discharging into the Kam River.

Process Data

The average daily flow for 1965 was 1.85 mgd. This represents 31% of design. From the probability curve the design flow of 6.0 mgd is exceeded approximately 2% of the time. High flows during storm and runoff periods cause the curvature of the probability curve and the steep slope at the left end of the curve.

It is anticipated that with the completion of a main trunk sewer in 1966, the flow will be increased to a point closer to design flow.


PROBABILITY OF DAILY FLOWS
MILLION GALLONS PER DAY
9.600
8.600
7.600
6.600
5.600
4.600
3.600
2.600
1.600
.600
DESIGN FLOW
0.01
0.05
0.1
0.2
0.5
1
2
5
10
20
30
40
50
60
70
80
90
95
98
99
99.8
99.9
99.99
PERCENT OF TIME FLOW IS EQUAL TO OR GREATER THAN
1964
1965


AVERAGE DAILY FLOW
M.G.D.
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
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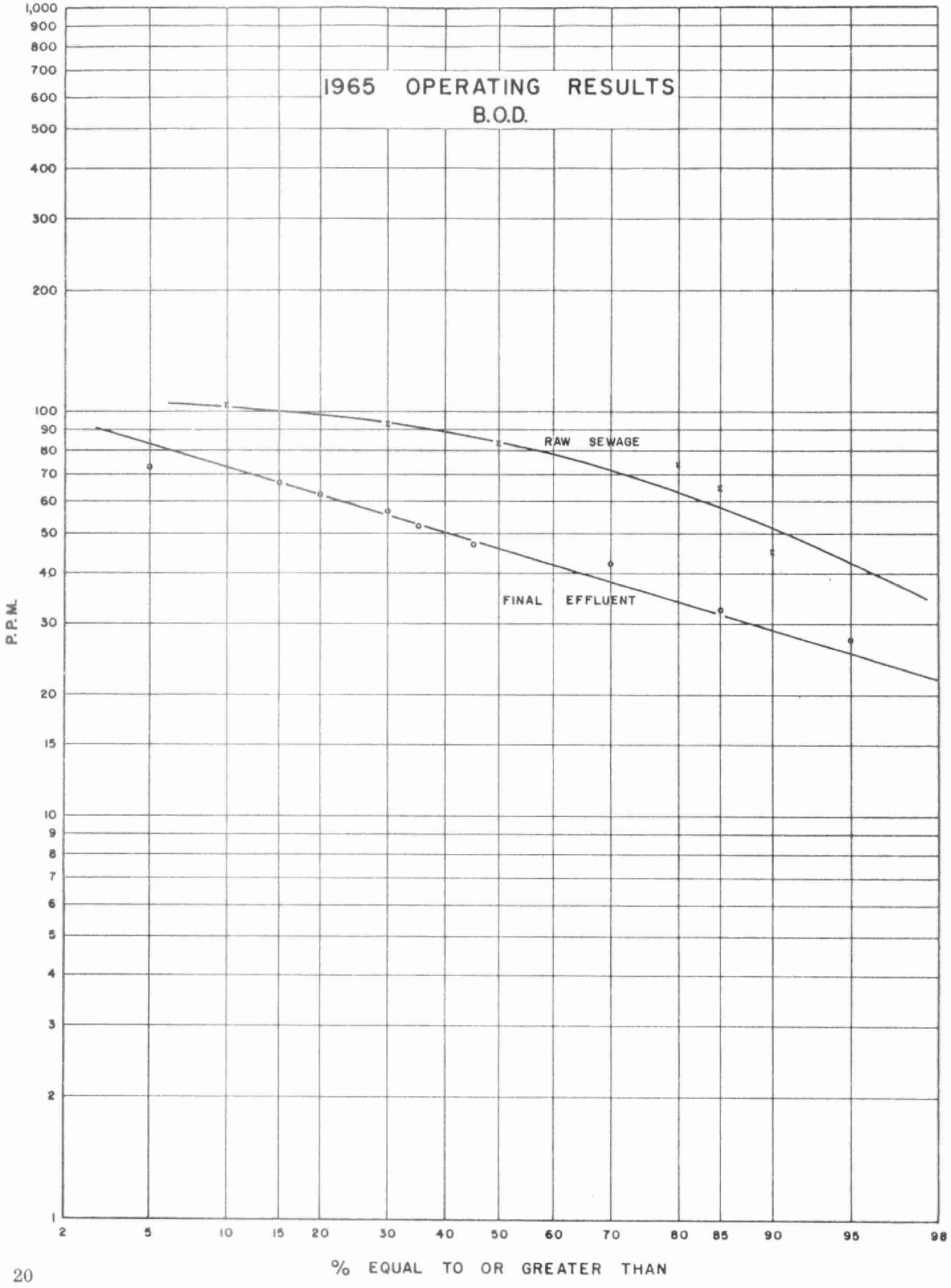
JAN FEB MAR APR MAY JUNE JULY AUG. SEPT OCT. NOV. DEC.
1964
1965
19____
19____
19____


1965 OPERATING RESULTS
B.O.D.
RAW SEWAGE
FINAL EFFLUENT
P.P.M.
% EQUAL TO OR GREATER THAN
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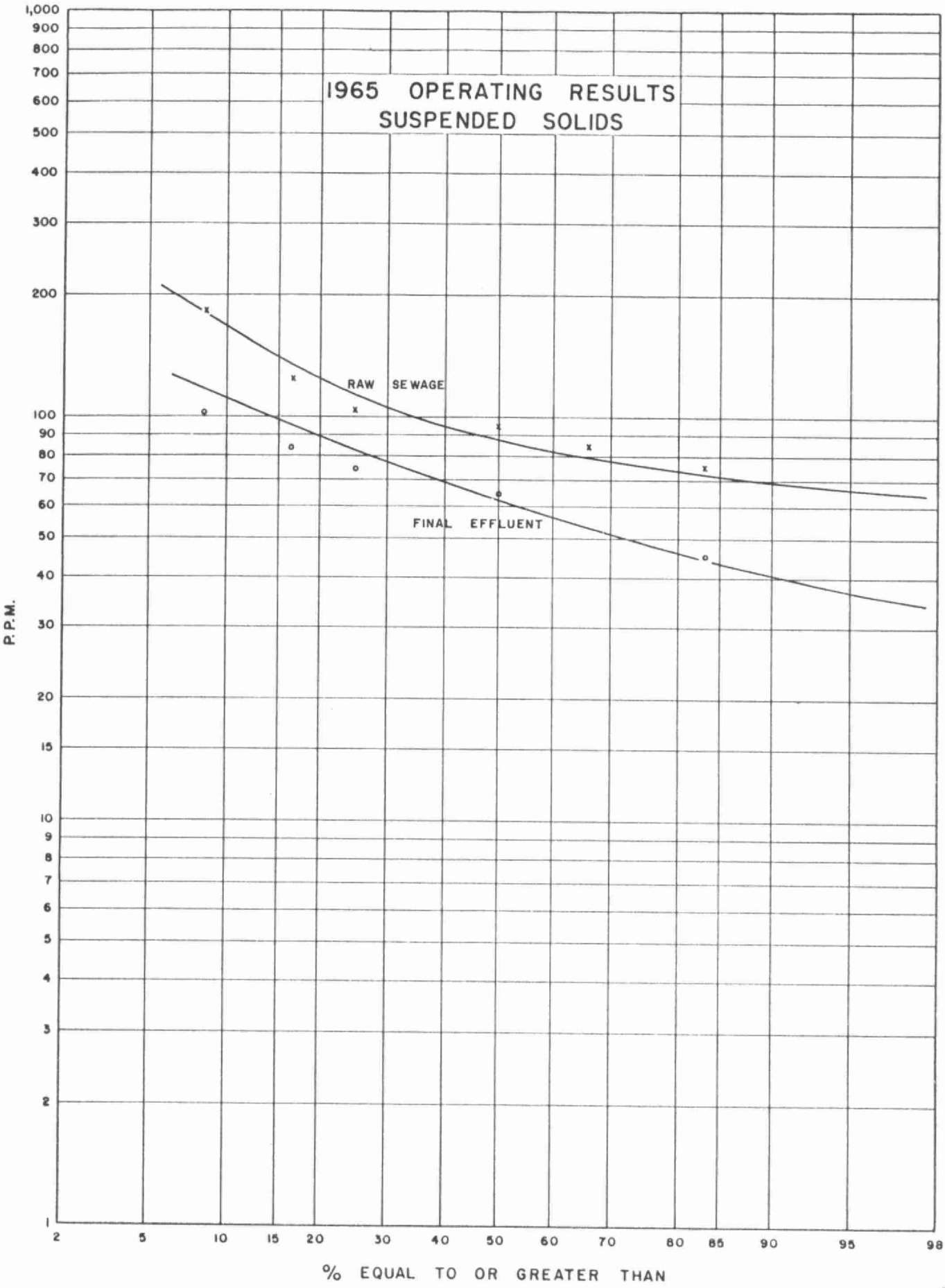
1965 OPERATING RESULTS
SUSPENDED SOLIDS
RAW SEWAGE
FINAL EFFLUENT
P.P.M.
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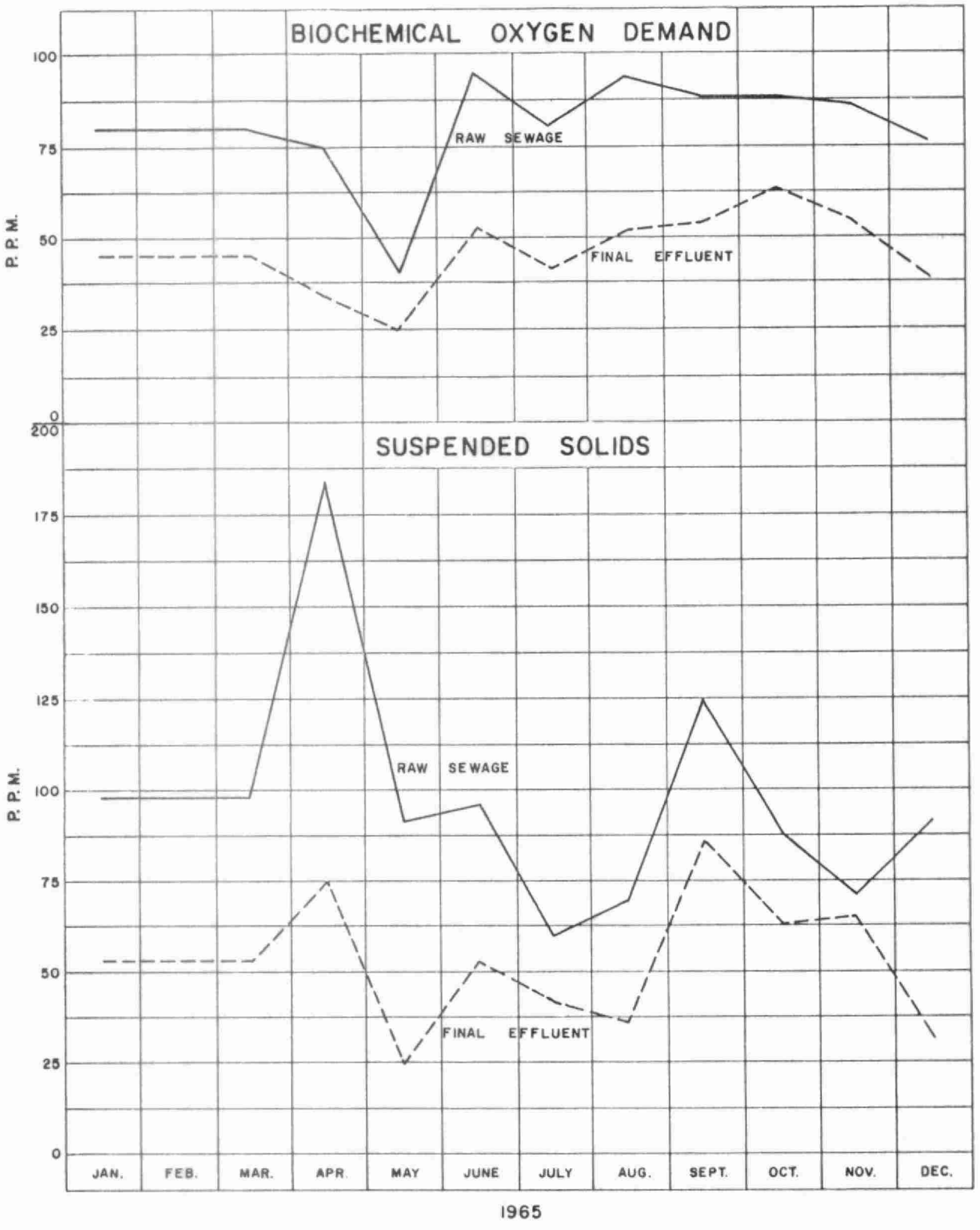
% EQUAL TO OR GREATER THAN


BIOCHEMICAL OXYGEN DEMAND
P. P. M.
100
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25
0
RAW SEWAGE
FINAL EFFLUENT
SUSPENDED SOLIDS
P. P. M.
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175
150
125
100
75
50
25
0
RAW SEWAGE
FINAL EFFLUENT
JAN.
FEB.
MAR.
APR.
MAY
JUNE
JULY
AUG.
SEPT.
OCT.
NOV.
DEC.
1965

GRIT, B.O.D AND S.S. REMOVAL

MONTH	B. O. D.				S. S.				GRIT REMOVAL CU. FT.
	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	
JAN.	* 80	46	42.5	3.7	* 98	53	46.0	4.8	130
FEB.	* 80	46	42.5	2.8	* 98	53	46.0	3.8	-
MAR.	* 80	46	42.5	6.2	* 98	53	46.0	8.2	108
APR.	75	34	54.5	24.7	184	75	59.0	65.8	321
MAY	41	25	39.0	9.0	92	25	19.5	37.5	320
JUNE	95	53	44.0	12.8	96	53	44.5	13.1	144
JULY	80	42	47.5	10.4	60	42	30.0	5.0	243
AUG.	93	52	44.0	8.4	70	36	48.5	7.0	228
SEPT.	88	54	38.5	14.6	125	87	30.5	16.4	288
OCT.	88	63	28.5	8.8	88	63	28.5	8.8	135
NOV.	86	54	37.0	5.4	71	65	8.5	1.0	275
DEC.	76	38	50.0	4.0	92	32	65.0	6.4	-
TOTAL	-	-	-	115.0	-	-	-	152.2	2192
AVG.	80	46	42.5	9.6	98	53	46.0	12.7	219

* Average values substituted. No sample taken

COMMENTS

Chemical samples above indicate a relatively weak raw sewage both in terms of BOD and SS. Percentage removal is good for this type of plant treating such weak sewage.

The amount of grit removed from the sewage is relatively high.

All of the above factors indicate a small amount of domestic waste and a large portion of storm water and/or infiltration.

DIGESTER OPERATION

MONTH	SLUDGE TO DIGESTERS			SLUDGE FROM DIGESTERS			GAS PRODUCED 1000'S Cu. Ft
	1000'S CU.FT.	% SOLIDS	% VOL. MAT.	1000'S CU.FT.	% SOLIDS	% VOL. MAT	
JAN	16.60	-	-	-	-	-	31.89
FEB.	16.88	-	-	-	-	-	25.36
MAR.	24.64	-	-	-	-	-	41.34
APR.	38.86	1.86	-	-	-	-	42.69
MAY	33.65	-	-	-	18.05	-	41.85
JUNE	21.89	-	-	-	-	-	37.60
JULY	17.60	4.72	3.16	-	8.72	3.43	38.96
AUG.	15.96	-	-	-	-	-	33.05
SEPT.	25.03	-	-	-	-	-	42.41
OCT.	28.46	-	-	-	-	-	259.61
NOV.	16.22	-	-	-	-	-	212.81
DEC.	24.29	-	-	-	-	-	234.50
TOTAL	280.08	-	-	-	-	-	1042.07
AVG.	23.34	3.29	3.16	-	13.38	3.43	86.84

COMMENTS

The total amount of sludge pumped to the primary digester was 280,080 cu. ft. To date it has not been necessary to haul digested sludge, since low flows have permitted the secondary digester to be used for sludge storage.

Gas production is normal relative to the volume of sewage treated.

CHLORINATION

MONTH	PLANT FLOW (MG)	POUNDS CHLORINE	DOSAGE RATE (PPM)
JANUARY	21.57	-	-
FEBRUARY	16.69	-	-
MARCH	36.66	-	-
APRIL	120.72	-	-
MAY	111.91	* 4855	7.91
JUNE	60.89	7903	12.98
JULY	55.03	5152	9.36
AUGUST	41.16	4326	10.51
SEPTEMBER	86.07	5559	6.46
OCTOBER	70.56	5931	8.40
NOVEMBER	33.86	890	2.63
DECEMBER	21.26	1425	6.70
TOTAL	676.38	36041	-
AVERAGE	56.36	4505	8.38

* 17 days chlorination

COMMENTS

Chlorination is practiced at the Fort William plant from May 15 to November 30 of each year.

During this period it was required to dose the final effluent at a rate of 8.38 ppm to maintain a residual of 0.5 ppm after 15 minutes.

Chlorine dosage is high in a primary treatment plant due to the high solids content of the effluent at the point of chlorination.

CONCLUSIONS

Although the plant is lightly loaded, it can still be operated with good efficiency and relatively low costs.

Costs in 1966 will increase due to the added expenses incurred at the renovated Brunswick Pumping Station. However, with the anticipated increase in flow, unit cost per million gallons will be reduced.


ONTARIO WATER RESOURCES COMMISSION